ELECTRONIC DEVICE CONTROLLER BASED ON INTERNET OF THINGS USING ESP32 AND BLYNK

Compiled as one of the requirements for completing the Undergraduate Study Program at the Informatics Study Program, Faculty of Communication and Informatics

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2021

APPROVAL PAGE

ELECTRONIC DEVICE CONTROLLER BASED ON INTERNET OF THINGS USING ESP32 AND BLYNK

SCIENTIFIC PUBLICATIONS

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NIK. 969

RATIFICATION PAGE

ELECTRONIC DEVICE CONTROLLER BASED ON INTERNET OF THINGS USING ESP32 AND BLYNK

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Abstrak

Perangkat teknologi informasi yang dimiliki manusia kini dapat mengakses informasi apapun dengan mudah dengan menggunakan koneksi internet. Teknologi internet juga memberikan ide untuk menciptakan dan mengembangkan berbagai inovasi teknologi. Manusia dapat menjadikan berbagai macam perangkat sebagai alat bantu dalam melakukan berbagai aktivitas dalam kehidupan sehari-hari agar dapat digunakan secara tepat, efektif dan efisien. Salah satu perangkat pendukung tersebut adalah penerapan teknologi Internet of Things (IoT) yang merupakan bagian dari teknologi informasi dan dapat diterapkan pada perangkat elektronik. Internet of things (IoT) menghubungkan perangkat dan alat ke jaringan internet yang dapat dikendalikan oleh situs web dan aplikasi ponsel pintar, mengendalikan alat dan instrumen dengan kode dan struktur algoritma. Dalam hal ini peneliti ingin membuat sistem yang dapat membantu aktivitas manusia saat berada di dalam rumah maupun saat keluar dari rumah. Dengan menggunakan jaringan Wi-Fi sebagai pusat antara pengguna dan sistem. Penelitian ini menyarankan solusi yang dapat menghemat energi manusia dengan mengendalikan perangkat satu per satu. Menggunakan ESP32 sebagai mikrokontroler dari sistem, memungkinkan sistem ini untuk dapat mengontrol banyak hal dalam waktu yang bersamaan dan penambahan database Blynk Server dari aplikasi Blynk memungkinkan sistem ini dapat diakses dari jarak jauh dimana berfungsi untuk memonitoring keadaan perangkat elektronik saat pengguna tidak berada di rumah.

Kata kunci: Smarthome, ESP32, Blynk, Mikrokontroler, Arduino, Internet of Things.

Abstract

Information technology devices owned by humans can now access any information easily by using an internet connection. Internet technology also provides ideas for creating and developing various technological innovations. Humans can make various kinds of devices as a tool in when doing various activities in daily life to be used appropriately, effectively and efficiently. One of the supporting devices is the application of the Internet of Things (IoT) technology which is part of information technology and can be applied to electronic devices. Internet of things (IoT) connecting the devices and tools to the internet network that can be controlled by websites and smart phone applications, controlling the tools and instruments by codes and algorithms structures. In this case the researcher want to create system that can helping human activity when they at house or when they leave the house. By using a Wi-Fi network as a central between users and the system. This research suggests a solution that can save human energy by controlling the device one by one. Using ESP32 as a microntroller of the system, allows this system to be controlled a many things at the same time and the addition of the Blynk Server database from the Blynk application allows this system to be accessed from a long distance where it functions to monitor the state of electronic

device when the user is not in home.

Keyword: Smarthome, ESP32, Blynk, Microcontroller, Arduino, Internet of Things.

1. INTRODUCTION

1.1 Background

The progress of an increasingly modern era & technology that continues to grow rapidly every day[1]–[3]. Demand that humans create increasingly sophisticated and sophisticated technology, which can facilitate human activities in everyday life, as well as a tool or system that is not limited by distance and place, which is one of the biggest obstacles to current technological developmensts[4]–[6].

One technology that is currently popular is the Internet of Things, where every device connected to the internet can be controlled manually or automatically via a smartphone or websites[7], [8]. A lot of human work is helped by the existence of the Internet of Things, including as a media for monitoring and controlling electronic device at home via smartphone[9]. This is considered quite effective and efficient in implementing the Internet of Things in everyday life. By utilizing the Internet of Things as an automation media, you can minimize wasted time just to go and turn off or turn on a switch on an electronic device in a different place[10], [11]. Through the buttons on the smartphone application, users can control several electronic device at the same time.

This research is expected to be able to help facilitate human activities while at house and as a monitoring media when leaving the house. By viewing the status of an electronic device from the Blynk application, users can find out if an electronic device is on or off condition, and can control on / off at that time[3], [9], [10], [12]. The ESP32 is currently the newest and most advanced microcontroller from Arduino. Besides being able to be controlled via Wi-Fi network[13], [14], the ESP32 can also be controlled via a Bluetooth network which can be an alternative network resource when internet disruption at home. In this study, researchers used the Blynk application which can be downloaded via smartphone as a control media for the system being designed. With a simple and easy-to- understand interface, making Blynk the right choice as a control media for the designed system[15]. Monitoring and turning off several electronic device in a house at the same time is not well known by the public,

even though using this principle can save the energy and time needed just to check and control the electronic device at home.

Based on these problems, an "Electronic Device Controller based on Internet of Things Using ESP32 and Blynk" was researched which functions as a monitor and control of electronic device in a house via internet connection using one of the newest microcontrollers currently ESP32, with ESP32 which can controlled via Wi-Fi and Bluetooth connections are expected to provide efficient performance in this study. In monitoring and the media controller uses the Blynk application installed on the smartphone, where the Blynk application itself has its own database that can be accessed anytime and anywhere as long as it is connected to the internet network.

2. METHOD

2.1 Research Method

This research method uses experimental methods in which experiments are carried out on two different objects, to see how effective the system is if it is applied in everyday life. The first research was carried out on a simple house prototype which has 4 rooms where each room has 1 lamp. This research was conducted to test whether the system can control all the lights in the room or not. As well as to test the feasibility of the system before the system is applied directly to everyday life. The second research was conducted in a room in the form of a rectangular bedroom with a size (length) of 3 meters x (width) of 1.5 meters with a height of 1.5 meters, where the room has one light switch. The light switch is connected to the control device and can be operated via smartphone, as long as the controller and smartphone are connected to the internet network.

2.2 **System** Development

As has been explained in the background of this research, a system will be made as a solution or an alternative for controlling electronic device. This research will be developed using the Waterfall method[16],[17]. The selection of the waterfall method for developing this system is because the waterfall method is a simple method that has a sequential workflow ranging from analysis to system maintenance and each process has its own specifications so that the system can be developed precisely. Figure 1 shows the workflow using the waterfall method.

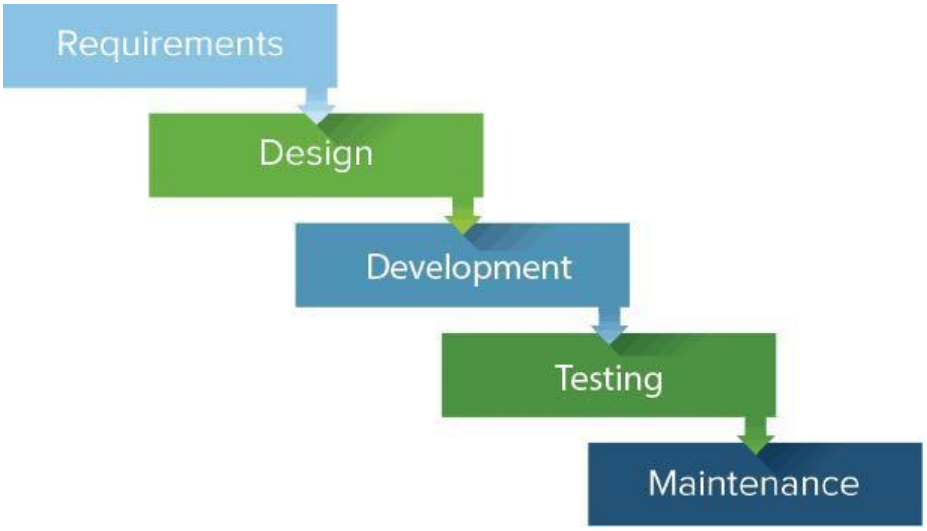


Figure 1. Waterfall Method Workflow

The following is an explanation of the workflow in Figure 1:

2.2.1 Requirment Analysis

a. Problem Identification

First problem is how to design a system that can control the switches on the electronic device in the house via the internet network. And the second is how to design a system that can control the switches on the electronic device that can be controlled remotely from long distance and using different connection.

b. Purpose

This research has a purpose to produce an system that can be used to control electronic device in the house and can be used via Android. And produce an system that can remotely monitor the state of the electronic device in the house from long distance and using different connection.

c. Benefits

Benefit from making this system is make it easier and save time for users while doing activities at home. And the second benefit is system can be controlled remotely from long distance and use a different connection.

d. System Analysis

The System can control the power of electronic device in a room. The system can make the user time and energy efficient when they want to sleep. The system can be controlled via a smartphone as long as there is a Wi-Fi network connected to the ESP32. The system can be controlled remotely due to a database that stores data electronic device.

e. Equipment and Material Needs

The tools and materials needed in making this system include:

First we need Smartphone, smartphone is a cellphone or smart cellphone equipped with the latest features and high capabilities like a computer. Which helps make human life easier because it can do several activities simultaneously at one time[5]. Smartphone is needed as a system control media that allows users to control the power of the electronic device. And the second is ESP32, ESP32 is the successor to the previous microcontroller, the ESP8266. In this microcontroller, there are two types of modules, Wi-Fi and Bluetooth module, so that it supports the creation of an Internet of Things application system[8][10]. Esp32 here functions as a connector between the electronic device and a smartphone that connected to Wi-Fi. The next equipment we need is Relay, Relay is an electronic component in the form of an electrical switch that is moved by an electric current. The relay has a middle-low coil wrapped around a core, there is an iron armature that will be attracted to the core when current flows through the coil. Relay is a switch that is operated electricaly and is an electromechanical component consisting of 2 main parts, namely electromagnet and mechanical[5], [8], [11], [14]. Relay here acts as a substitute for a light switch that can be controlled via the ESP32. For the writing the program code we need Arduino IDE, Arduino IDE is an open-source software that is used to compile, edit, and upload script code to the ESP32, so that the ESP32 can be executed using the script code that has been created[4], [11]. And the last thing is Blynk Application, Blynk is an application service that is used to control microcontroller via the internet network. Blynk is a new platform that allows users to quickly build interfaces that are useful for controlling and monitoring hardware projects from iOS and Android devices[4], [11].

2.2.2 System Design

System Design Stage is a description of the system process to be created. Includes the design of the Use Case Diagran Activity and the System Schematic to be built. The following shows the Use Case in Figure 2.

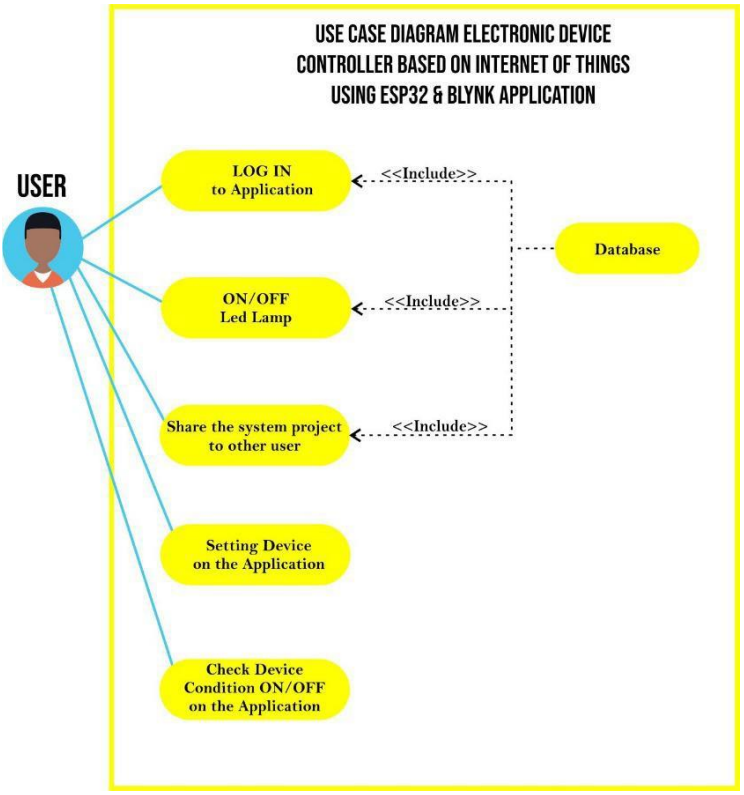


Figure 2. Use Case Diagram

Figure 2 illustrates the model of the system being designed, namely "Electronic Device Controller Based on the Internet of Things Using ESP32 & Blynk Application", this is the Use Case Diagram that contain interaction between user and system. The user is the main actor in the control system, because the user provides input in the form of commands to the program so that output functions can be generated. An Android smartphone that has the 'Blynk' application installed is a device that the user uses to send commands to the program. A wireless data communication device that connects an Android smartphone to a microcontroller. The microcontroller is the main component that regulates the entire series of input and output (output) work processes. Relay is a component that connects all electronic devices to be controlled.

The initial stage for controlling, the user connects an Android device to the program by activating the internet on the Android device. Then, to connect between wifi and the module, the user needs to enter the name and password of the wifi to be used. Next, open the Blynk app and activate the electronic device. Once installed, users can control and enter commands by pressing a button on the Blynk application display. When the application is run, the application will display the main menu in which it consists of commands to change power to electronic device.

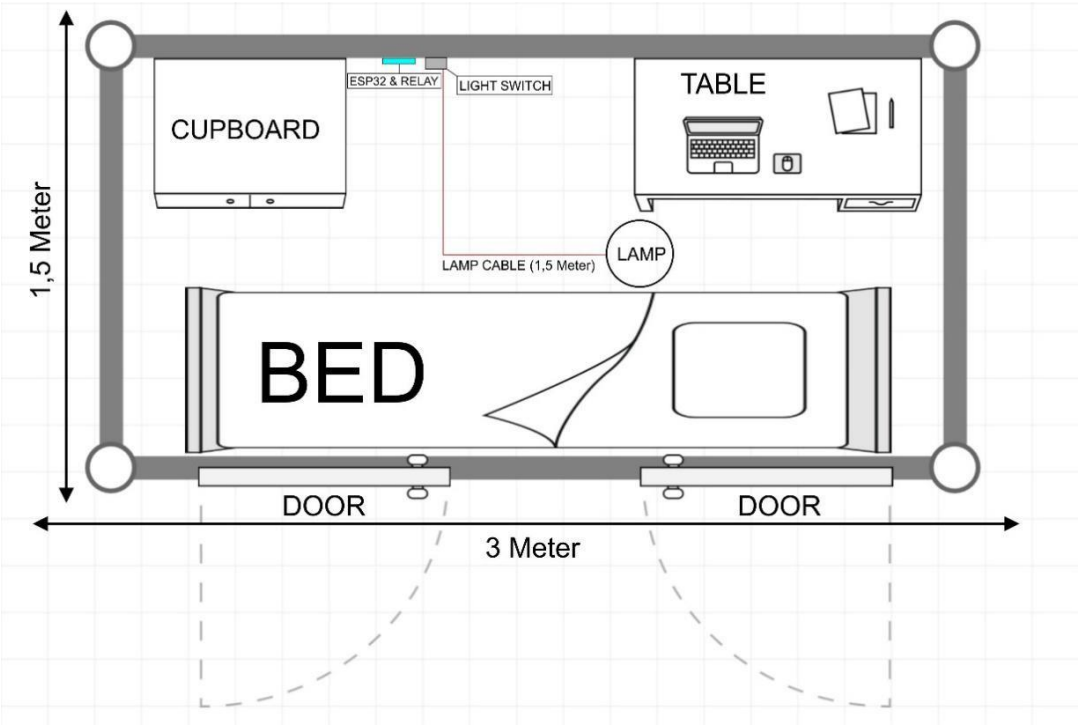


Figure 3. System Schematic

Figure 3 describe the implementation of system in a bedroom,the ESP32 is connected to Lamp Switch. The light switch functions only as a source of conducting electronic energy to the system, then the control on and off will be carried out by the ESP32, the ESP32 will send an ON / OFF command to the relay where the relay itself functions as a switch here. After the command has been given to the relay, the relay will make power settings for the lights to be turned on or off. That way the lights can be controlled according to the user's wishes, with a room spanning 3 x 1.5 meters of cable needed to connect the switch to the 1.5 meter lamp.

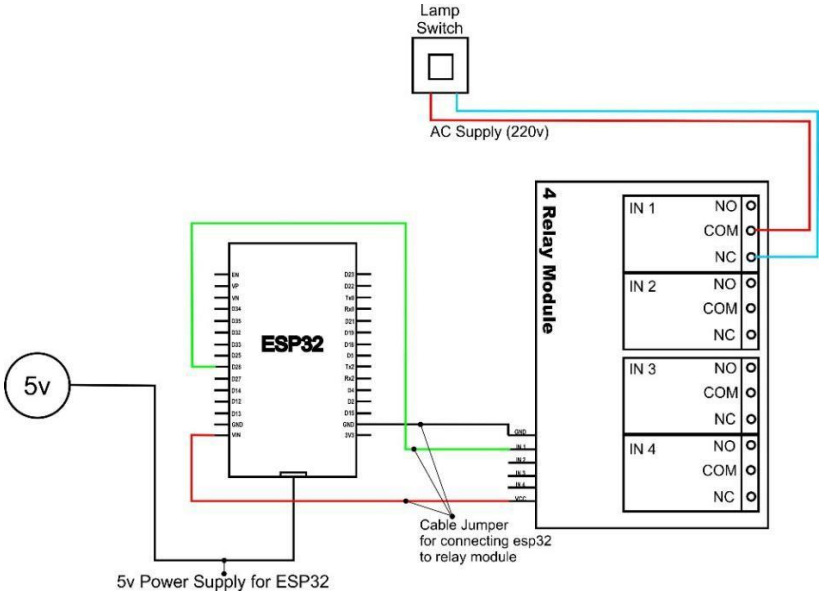


Figure 4. Electrical Schematic

Tests are carried out using two different Wi-Fi which are useful as a determining indicator whether the system can be controlled via different networks or not. Then the test is carried out at different distances, where the first test is in one house and the second test is in a house that is a few meters from the user's house, this is done to check whether the system can be controlled remotely from long distance or not.

2.2.3 System Programming

Make a program or system code to be able to connect to a smartphone via the Internet network using the Arduino IDE and Blynk application.

a. System Flowchart

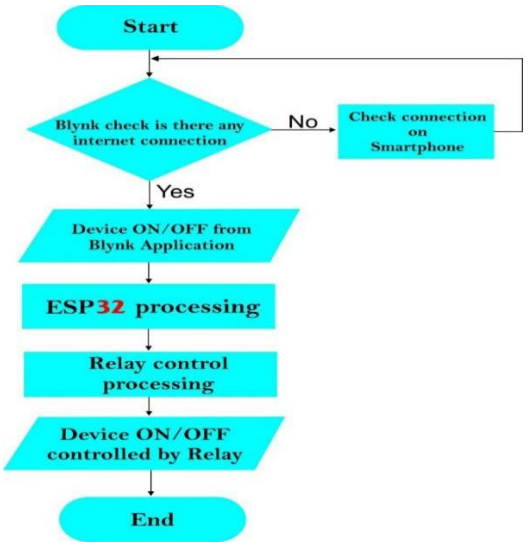


Figure 5. System Flowchart

Figure 4 shows how the system working. The Blynk Server checks the network used in the connecting process between ESP32 and the blynk application. Checks ESP32, the Blynk application token and the program code, as well as the hotspot name and password used. The information written in the program code must match the Wi-fi information to allow ESP32 is connected to Wi-F- as a place to exchange commands between smart phones and ESP32. The final process in this research is to identify the command sent from the Blynk application to the ESP32 to control the load connected to the relay kit. And the sensor output value is sent in reverse to the Blynk application from the ESP32 kit. After going through the following steps, the system can be used immediately by the user[2], [3], [6], [10].

b. Blynk Application System Design (Connection between blynk & esp32)

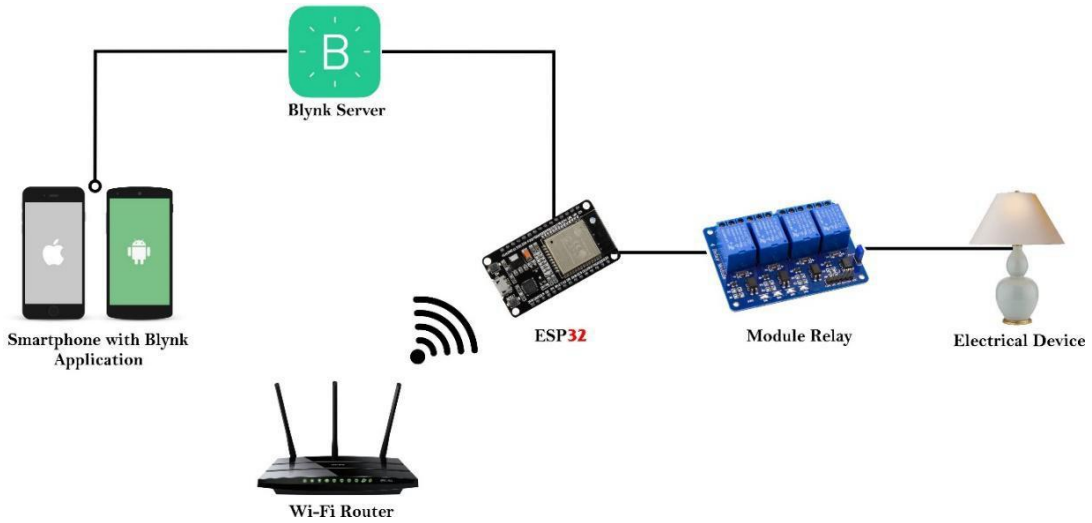


Figure 6. Blynk System Workflow

To be able to run the system, researchers need to install the Blynk application on a Smartphone, then after that do the system coding on the computer to be able to connect Blynk with the ESP32. After the code has been written, the system code is entered into the ESP32, which will later function to connect the relay module to the Smartphone via the internet network. The relay itself functions as a replacement switch that can disconnect or connect electronic power to electronic device via digital control.

2.2.3 System Testing

The next stage after the coding process, the system will be tested whether it runs as desired or not. If the system has a bug or error, it will be immediately reported and fixed so that it runs well as the existing design.

2.2.4 Maintenance

This stage is the last stage in the waterfall method. The system can be implemented. Maintenance includes corrections of various errors found during testing, improvements to the implementation and development of the software, and program maintenance. In addition, the maintenance of a system can be carried out by administrators to improve the quality of the system so that it is much better.

3. RESULT AND DISCUSSION

In conducting this research, the researcher conducted two tests on the system, the first test was done to see how effective the system if it was used in everyday life, where this test was applied on the lights in the bedroom. And the second was to see how many tools were used electronics that can be controlled by the system, through a simple miniature house where there are four lights installed in each room.

3.1 Testing in house room

The Test is done by pressing the ON/OFF button on the Blynk Application. This can be done when the system is turned on and connected to Wi-Fi connection. The test taking of one week, starting from may 2021 , in this case the researchers want to try how effective this syetem when applied in daily life. The result of the test is in Table 1.

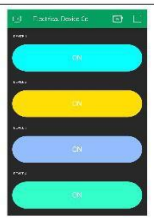
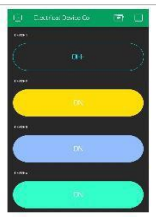
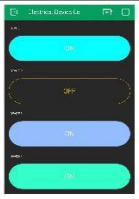
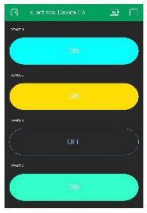
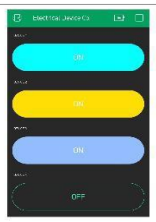
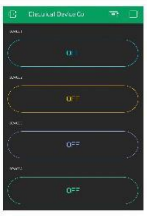
Table 1. Testing on The Light in the Bedroom

SWITCH STATUS	CONDITION	PRACTICE
	ON	
	OFF	

3.2 Testing in house prototype

This test doing to see how much the device can be controlled by the system , because it is not possible to change the house electronic circuit , so the researcher using the mini house prototype that have four room on it. Researcher put one lamp in each room, so the total device is controlled or being tested here is four device. The result of the test is in Table 2, the ON and OFF condition in each and all device.

Tabel 2. Testing in Mini House Prototype

SWITCH STATUS	ON	OFF	CONDITION
		- DEVICE 1 - DEVICE 2 - DEVICE 3 - DEVICE 4	
	- DEVICE 1	- DEVICE 2 - DEVICE 3 - DEVICE 4	
	- DEVICE 2	- DEVICE 1 - DEVICE 3 - DEVICE 4	
	- DEVICE 3	- DEVICE 1 - DEVICE 2 - DEVICE 4	
	- DEVICE 4	- DEVICE 1 - DEVICE 2 - DEVICE 3	
	- DEVICE 1 - DEVICE 2 - DEVICE 3 - DEVICE 4		

3.4 User Satisfaction Survey Results

The calculation of the questionnaire will use the following formula[18]: n = total respondents who gave an assessment

Highest Score (SMax) = 5 x n (1)

Total Score = 5 x n(SS) + 4 x n(S) + 3 x n(B) + 2 x n(TS) + 1 x n(STS) (2)

$$\text{Interpretation Percentage} = \frac{\text{Total Score}}{\text{SMax}} \times 100\%$$

From the above formula, it will be known the average user satisfaction result.

Tabel 3. Shows the result of User Satisfaction Survey Result

Quiz Code	SS (5)	S (4)	B (3)	TS (2)	STS (1)	Total Score	SMax	Interpretation Percentage (%)
Q1	14	14	2	0	0	132	150	88%
Q2	9	19	2	0	0	127	150	85%
Q3	12	16	2	0	0	130	150	87%
Q4	18	8	4	0	0	134	150	89%
Q5	17	8	5	0	0	132	150	88%
Q6	13	13	3	1	0	128	150	85%
Q7	13	14	3	0	0	130	150	87%
Q8	18	12	0	0	0	138	150	92%
Q9	10	17	3	0	0	127	150	85%
Q10	20	9	1	0	0	139	150	93%
Average Percentage								88%

On the Tabel 3 the average obtained after the test that was given to 30 respondent is 88%. Based on customer satisfaction index, users are very satisfied using this system.

3.3 System Analysis

From the two tests above, the system functions in accordance with the objectives of this study. Which is where on the first test, researchers draw conclusions that the program is very helpful. It is more easier to change lamp condition without need to come over the switch, just need to open the application and turn ON / OFF the lamp by the application. Whereas in the second study, all the lights contained in the prototype of the house can be turned on, which means that the system can control more than one electronic device at the same time as long as the electronic power to be controlled does not exceed the power on the relay. The comparison of this study from previous research is the

microcontroller used where this study uses the ESP32 which has a Bluetooth module, which in previous studies still used the previous microcontroller, namely the ESP8266. The system has been successfully built with hardware that is arranged in such a way as to achieve the results as expected.

4. CLOSING

4.1 Conclusion

The conclusion that can be drawn from this research this electronic device control system is already functioning properly on each of its features based on the blackbox testing that has been done and based on the user satisfaction survey that has been carried out by distributing questionnaires to 30 respondents who tested the system, the average value obtained from the survey results touched the number 88 % which can be concluded that the respondents is very satisfied with the system and the system is acceptable to use when implemented in real life.

4.2 Suggestions

The suggestions from the researchers in this study are that if we want to apply this system to one house, first thing that must be done is to design the electronic scheme in the house so that the system can be connected to the device you want to control directly, and maybe for further research, maybe some sensors can be added to be able to turn off or turn on electronic devices.

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